IDAHO COMPLETION PROJECT’S REAL-TIME WIPP/RCRA FIELD SAMPLING AND ANALYSIS PLAN FOR A DESCRIBED AREA WITHIN PIT 4

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ABSTRACT

This plan addresses the sampling and analysis of homogeneous solids and soil/gravel for a described 0.5 acre area within the Idaho National Engineering and Environmental Laboratory’s (INEEL’s) Pit 4. The sampling methodology is area-based and relies on constrained random selection. This sampling and analysis plan addresses both the spatial and temporal variability of the waste, consistent with U.S. Environmental Protection Agency (EPA) sampling methodologies found in Statement-of-Work-846, Chapter 9 (1). This plan also meets the U.S. Department of Energy (DOE) Carlsbad Field Office’s (CBFO) Waste Analysis Plan (WAP) requirements (2). Thirty samples will be collected in the first ¼-acre, sixty for the 0.5 acres. These samples will be collected real time during retrieval. To demonstrate compliance with CBFO WAP data quality objectives, the sampling design will confirm that the sample size is sufficient.

INTRODUCTION

The INEEL was used for subsurface disposal of both transuranic (TRU) and low-level waste in various pits and trenches from 1952 until 1970, when the practice was suspended in favor of above-ground retrievable storage. Several areas contain relatively large amounts of TRU or organically contaminated waste. As part of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) non-time critical removal action, select areas within Pit 4 were chosen for retrieval by DOE Idaho, with agreement from the EPA and the Idaho Department of Environmental Quality. The Idaho Completion Project (ICP) Accelerated Retrieval (AR) Project will retrieve and process Pit 4 TRU waste for ultimate disposal at the Waste Isolation Pilot Plant (WIPP). Before the INEEL ships TRU waste to the WIPP, the CBFO WAP (2) requires Resource Conservation and Recovery Act (RCRA) sampling and analysis confirmation of Acceptable Knowledge (AK) and assignment of toxicity hazardous waste codes as appropriate. The AR Project has developed a unique sampling and analysis plan to compliantly characterize Pit 4 homogeneous solids and soil/gravel at the time of packaging, allowing for accelerated shipment of waste. This plan characterizes the homogeneous solids and soil/gravel contents of the described Pit 4 area, in one sampling lot. The sampling and analysis process will be implemented under Central Characterization Project (CCP) WIPP certification authority.

Pit 4 Wastes

Understanding the waste within Pit 4 is pivotal in determining and designing a comprehensive sampling plan. Following is a discussion of the waste as it was disposed and as it currently exists.

“As Disposed” Waste Overview

The majority of the waste disposed in Pit 4 came from the Rocky Flats Plant (RFP) and consisted of both debris and homogeneous solids. INEEL generators also disposed of waste within the 1/2-acre described area of Pit 4. A summary of as-disposed volumes, weights, and waste categories for shipments intersecting the retrieval area of Pit 4 is given in Table I.

Table I. Pit 4 Described Area Summary of As-Disposed Volumes, Weights, and Waste Categories.

Waste Category	Number of Containers	Weight (lb)	Volume (ft^3)
[a]RFP Series 741 sludge (1st stage)	886	450,640	6,514
[a]RFP Series 742 sludge (2nd stage)	770	376,374	5,656
[a]RFP Series 743 sludge (organic setups)	634	339,609	4,662
[a]RFP Series 744 sludge (special setups)	81	38,188	597
RFP Beryllium	187	41,645	1,368
RFP Roaster oxide	109	73,909	801
RFP Graphite	490	115,299	3,599
RFP Filters	681	125,892	12,331
RFP comb debris	1,911	212,674	14,041
RFP metal debris	1,585	622,379	32,688
RFP mixed debris	1,341	192,904	12,796
Non-RFP sludge	3	42,000	1,272
Non-RFP comb debris	13	22,500	1,715
Non-RFP metal debris	32	196,919	14,920
Non-RFP mixed debris	39	140,650	7,891
Totals	8,762	2,991,582	120,851

a. Solids analysis data is available on this waste form from the INEEL 3100 m^3 Project

The disposal process involved excavating an area with a tractor-drawn scraper to the underlying basalt, followed by backfilling and leveling with a layer of native soil approximately 2-ft thick on which the waste was placed. The waste zone was approximately 12 ft deep when completed. Overburden soil was placed on the waste at a thickness of 4 to 9 ft. Waste was disposed as received; hence, waste categories are commingled within the pit.

“As-Retrieved” Waste Conditions

In spring 2004, the INEEL Glovebox Excavator Method Project retrieved approximately 60 m^3 (packaged into 454 drums) of buried waste from Pit 9. Because the waste and conditions are analogous to Pit 4 this effort yielded valuable insight. Figure 1 provides a picture of the first signs of commingled waste material in Pit 9. Figure 1 shows sludge (brown material), drum remnant, shredded plastic, and soil. In genera, drum conditions within the retrieval area ranged from completely deteriorated, i.e., could be ripped by leather-gloved hands in the glovebox, to relatively intact, i.e., would still hold waste. Of the corroded drums, only the drum lock rings had any integrity, but these could be folded by hand. There may be a correlation between drum condition and depth, with deeper drums being more corroded. This was not, however, evaluated in detail.

Based on Glovebox Excavator Method observations, sludge could be differentiated from soil, as long as material mixing was avoided. A wide range of sludge colors (e.g., gray, olive-gray, dusty yellow, rust, and pale orange) and textures (e.g., pasty, peanut butter, shiny, silty, greasy, wet, play dough) was noted. Sludges were still largely contained inside the waste bags, but were liberated by excavation activities. Soil constituted a significant fraction of the material within the waste zone as illustrated in Figure 1. Soil was often retrieved with sludge. There has been contaminant migration. Visibly contaminated soil was observed in the waste zone. In addition, volatile organics within the zone have migrated from their original disposal location. Shallow soil gas measurements (30 in. below ground surface) have detected carbon tetrachloride at concentrations up to 6,400 ppmv (3). Organics have also migrated downward: carbon tetrachloride has been detected in the vadose zone.

Fig. 1. The first signs of waste material within Pit 9.

In general, debris waste inside plastic bags (both polyethylene and polyvinylchloride) was in excellent condition. Debris was easily distinguishable once released from the bag; however, it is not possible to distinguish a bag containing debris from a bag containing sludge by visual observation in the pit. Some of the bags may have been breached during original disposal operations. Plastic drum liners were in good condition; some plastic was still elastic and could carry a load, while other plastic seemed to be dry, brittle, and could not carry a load.

WAP Implementation Challenges

Implementation of a WAP-compliant sampling program is challenging. The waste cannot be retrieved as it was disposed. There is little or no container integrity. Segregating according to the “as-disposed” waste forms is not possible due to the extensive handling required and resulting radiation dose to personnel. In addition, there is contaminated interstitial soil. Retrieval results in additional commingling. Given this, the anticipated retrieved Pit 4 waste streams will be rolled up to homogeneous solids, soil/gravel, and heterogeneous debris. Discussed below are the challenges this waste presents.

Control Charting

As defined in the WAP, retrieved waste meets the definition of newly generated waste. The CBFO WAP requires sites generating newly generated, mixed homogeneous solids waste streams to develop baseline control charts for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. As stated in the WAP B-3d(1)(a), “Process changes and process fluctuations will be determined using statistical process control charting techniques; these techniques require the ten-sample baseline and historical data for determining limits for indicator species and subsequent periodic sampling to assess process behavior relative to historical limits.” A control chart for means can be used for checking whether current data are consistent with past data and whether shifts or trends in means have occurred. The control chart for means is constructed of a centerline and upper and lower control limits that are based on the mean and standard deviation of historical data for the process. If a current sample mean from the process lies within the limits, the process is said to be “in control,” or consistent with historical data. If the current mean exceeds the limits, the process has likely deviated from the historical period. If the data identifies a new hazardous constituent or a new waste stream, the waste would be considered a process batch. Sampling would be halted and the waste would have to be re-characterized.

The adequacy of control charting Pit 4 retrieved waste was evaluated using existing RFP solids analysis data collected during the 3100 m^3 Project. These waste streams are from the same RFP processes as the waste forms identified in Table I. The generation timeframes vary: the Pit 4 waste is pre-1970 while the 3100 m^3 data was post

1970. Based on AK, however, the RCRA constituents did not vary significantly. Therefore, the 3100 m^3 data can be used to assess the viability of control charting.

The historical 3100 m^3 Project data describes samples of chloroform collected from 50 sludge drums from four 3100 m^3 Project waste streams packaged between December 1972 and June 1983: 1st stage sludge, 2nd stage sludge, organic setups, and special setups. As previously discussed, these waste streams are commingled within Pit 4. The control charting process was simulated by ordering subsequent data by time from June 1983 through July 1988. Means were calculated for each group of five chloroform measurements. Each group of five chloroform measurements are from five successively packed drums. The means are displayed in Figure 2 as solid dots and correspond to 24 time periods between June of 1983 and July of 1988. For simplicity, the horizontal axis is labeled 1 to 24. From this data set of 50, the mean was calculated as 129 and the upper and lower control limits were calculated as 33 and 225, respectively. These are shown as solid lines in Figure 2.

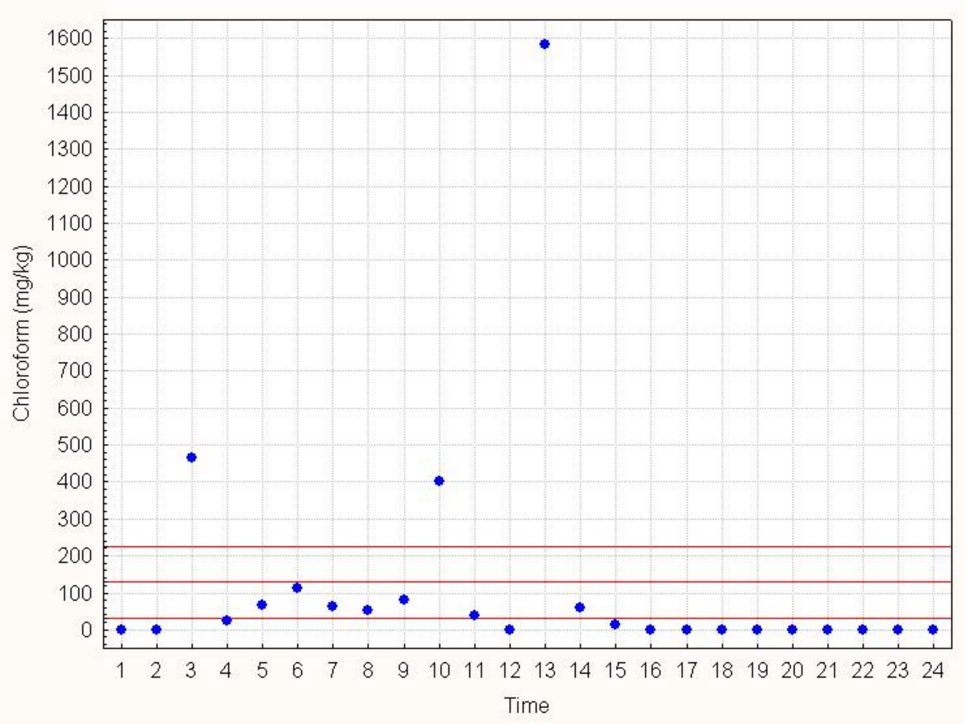

Fig. 2. Control chart for chloroform.

Notice that the mean for the first two time periods is less than the lower control limit while the mean for the third time period exceeds the upper control limit. This indicates a deviation from the historical period, and under real circumstances, WAP criteria would require that the waste stream be recharacterized, and the characterization be performed according to procedures documented in the WAP. This would result in unacceptable delay in shipping and additional cost.

A similar analysis was performed for four other analytes with sufficient data. Two of those, 1,1-dichloroethylene and carbon tetrachloride, exhibited significant deviations from the control limits based on historical data, further confirming that control charting is not viable. Interrupting the sampling and analysis process for recharacterization whenever a group mean is out of control is not appropriate in the current situation. Therefore, control charting will not be performed on waste retrieved from Pit 4. If newly generated waste cannot be control charted, the WAP allows for characterization of waste as retrievably stored. Typically, WAP RCRA sampling for retrievably stored waste is implemented after packaging. Drummed waste is broken into waste streams and drums randomly selected for coring. This results in an unacceptable time delay to retrieve, store, characterize, and then ship waste. Real-time drum selection is an alternative but presents challenges as discussed below.

Estimating the Number of Drums within a Waste Stream

Estimating the number of containers within a Pit 4 waste stream is problematic. A range, however, can be estimated. Consider the following illustration: 2,371 containers of homogeneous solids were disposed in the described area of Pit 4 using the values reported in Table I. A container is assigned to a waste stream if it contains >50% by volume or is a plurality of the waste within a drum. The final amount of commingled soil retrieved with this sludge is unknown. Assume, for example, that the percentage of soil retrieved with the homogeneous solids ranged from 20% to 40%. The number of drums defined as homogeneous solids, using the plurality rule, could vary significantly. Examples of two simple scenarios are given below:

At 20% commingling with soil, the number of homogeneous solids drums increases from 2,371 to 2,845 (2,371 × 1.20 = 2,845). At 40% commingling with soil, the number of homogeneous solids drums increases to 3,319 (2,371 × 1.40 = 3,319).

The second case results in a decrease of drums classified as containing homogeneous solids. For the case where 20% of the original homogeneous solids volume is commingled with the soils, the number of homogeneous solids drums decreases to 1,897 drums (2,371 × 0.80 = 1,897). At 40% homogeneous solids commingling with soil, the number of homogeneous solids drums decreases to 1,423 drums (2,371 × 0.60 = 1,423).

Given these scenarios, the number of drums classified as homogenous solids could range from 1,423 to 3,319. This makes the selection of drums for real-time solids sampling, based on estimating drums within a waste stream, impractical. It is likely that drums of waste would not have an opportunity for random selection. The approach given in this sampling and analysis plan eliminates this variability.

Estimating the Number of Samples

Because the proposed sampling process for Pit 4 TRU waste occurs at the time of packaging, an estimate of the number of samples is needed prior to excavation. To ensure that a sufficient number of samples will be collected, existing 3100 m^3 Project solids data for these waste forms were statistically reduced and used to estimate the number of samples needed to meet WIPP WAP objectives.

In accordance with the WAP, preliminary estimates of the mean and standard deviation for chemical contaminants of concern are to be used for estimating the appropriate number of samples to be collected for each contaminant. The final sample size is driven by the largest sample size calculated among the contaminants of concern. Sample size is calculated using the following formula:

$$n = \frac{t^2_{0.90,n_0-1} s^2}{\left(RT - \bar{x}\right)^2}$$

where:

n_0 = the initial number of samples used to calculate the preliminary sample estimate
n = the calculated number of samples in the preliminary estimate
s^2 = calculated concentration variance
t^2 = the 90th percentile for a t distribution with n_0-1 degrees of freedom
RT = Regulatory Threshold of the contaminant (toxicity limit for toxicity characteristic wastes, program-required quantitation limit for listed wastes).

Existing 3100 m^3 Project data for the four waste streams, given above, were combined into a single data set and the mean, standard deviation, and sample size were calculated for each contaminant. Table II presents the results. The hazardous waste numbers (HWN) were reviewed as assigned in INEL-96/0280 Rev. 3 and are shown in the last column of Table II. Using the WAP statistical methodology, the sample size was calculated and is given in the seventh column. Consistent with the methodology used by the 3100 m^3 Project, if a HWN has been assigned, the calculated number is not used. The AR Project has no intent in removing HWNs based on sampling. As shown in Table II, all other sample sizes were calculated to be the minimum of five (eighth column).

Table II. Summary Statistics for Combined 3100 m^3 Project Waste Streams and Sample Sizes.

Analyte	Sample Size	Number Above MDL	Mean, mg/kg	Standard Deviation, mg/kg	RTL/ PRQL mg/kg	Number of Samples	WAP Compliant Number of Samples	HWN
1,1-Dichloroethylene	119	39	41.7	144	14	46	—	D029
1,2-Dichloroethane	119	15	7.93	41.3	10	635	—	D028
Benzene	118	2	0.882	1.04	10	5	5	
Carbon Tetrachloride	119	48	3,500	90,000	10	12	—	F001/ F002
Chlorobenzene	118	0	0.859	1.04	2,000	5	5	
Chloroform	119	37	178	771	120	281	—	D022
Methyl Ethyl Ketone	122	21	4.2	24.8	4,000	5	5	
Pyridine	122	14	8.09	66.4	100	5	5	
Tetrachloroethylene	118	40	11.3	49.7	10	1,654	—	F001/F002
Trichloroethylene	119	47	5.69	18.6	10	32	—	F001/F002
Vinyl Chloride	107	9	0.73	0.975	4	5	5	
1,4-Dichlorobenzene	117	0	2.37	4.12	150	5	5	
2,4-Dinitrotoluene	88	0	0.122	0.186	2.6	5	5	
Cresols	117	9	2.84	6.34	4,000	5	5	
Hexachlorobenzene	88	0	0.127	0.204	2.6	5	5	
Hexachloroethane	120	28	112	912	60	482	—	D034
Nitrobenzene	117	2	2.67	4.67	40	5	—	D036
Pentachlorophenol	117	0	3.75	6.48	2,000	5	5	
Ag	124	78	74.7	128	100	43	—	D011
As	124	65	3.76	4.55	100	5	5	
Ba	124	124	67.2	73.5	2,000	5	5	
Cd	124	122	8.89	15.7	20	5	—	D006
Cr	124	121	130	195	100	72	—	D007
Hg	124	35	0.844	2.38	4	5	—	D009
Pb	124	96	152	416	100	104	—	D008
Se	124	18	0.927	0.848	20	5	—	D010

An alternative approach would be to treat the four waste streams separately and calculate a sample size for each one. The variability would be effectively reduced, and in all likelihood, the sample size for each would be five and therefore, the total number of samples would be 20. In either case, a conservative sample size of 30 should be adequate to characterize the contents.

Confirmation of the Required Number of Samples

The WAP requires that upon completion of sampling and analysis, the required number of samples must be recalculated to ensure that a sufficient number of samples were collected. Sufficient means that the number of samples collected must be at least 80% of the recalculated sample size. The excavation of Pit 4 will not allow a return to the sampled area in order to take additional samples should the 80% requirement not be met. Based on the assessment above, the preliminary sample size of 30 should be sufficient. This number will be assessed periodically throughout the excavation and sampling campaign to allow for adjustment of the sample size if necessary. In the event of a missed sample location, the need to randomly select an additional sample location will be evaluated when the sample size is verified. If required, an additional location will be selected and documented.

SAMPLING

Sampling Objectives

The objective of this sampling effort is to characterize the homogeneous solids and the soil/gravel contents of the described area within Pit 4 as waste is being retrieved. Characterization of Pit 4 will be the estimation of mean concentrations and associated upper bounds for all contaminants of concern. This is accomplished through statistically designed sampling and analysis. The contents of each described area within Pit 4 will be considered a process batch. As discussed, the pit is composed of commingled waste from several different waste streams. Therefore, it is expected that the waste zone will not be homogeneous, but rather heterogeneous. The sampling plan considers this by addressing both spatial and temporal variability of the waste and is consistent with EPA methods found in SW-846, Chapter 9.

Temporal variability is inherently addressed because the waste will be considered as a process batch with the results applying to that batch. Spatial variability is addressed by using a constrained randomization scheme that, in a sense, forces an appropriate estimate of the variability across the waste zone. By stratifying the waste into three layers, each 4 ft thick, vertical heterogeneity is included in the variability estimate. Constrained randomization means that an equal number of samples are taken randomly from each 4-ft layer so that bias due to unequal sample sizes per layer is avoided. This is consistent with stratified random sampling discussed in SW-846, Chapter 9. Randomness of sampling at each layer also serves to protect against any type of horizontal bias, such as might occur with systematic or haphazard sampling at each layer.

Sampling Design

The approximate dimensions of the waste zone in Pit 4 are 263.8 × 126.2 × 12-ft deep, or an area of about 0.50 acres. Excavation and retrieval will be accomplished in two phases. Phase I is excavation of the first half of the described area. Phase II is the excavation of the second half of the described area plus an area within Pit 6 (directly to the east of Pit 4). The Phase I retrieval area is approximately 1/4 acre by 12 ft deep. The elevation at the surface of the retrieval area is at 5,014 ft and the elevation at which the waste zone begins is at about 5,011 ft. For RCRA purposes (WIPP acceptance), the 1/4-acre area in each retrieval phase will be sampled separately. According to the WAP, Section B2-2a, "Individual waste containers serve as convenient units for characterizing the combined mass of waste from the waste stream of interest." Identifying and sampling individual waste containers, real-time, presents significant challenges. It is unknown how many containers of waste will be retrieved from the described area of Pit 4 as discussed. Therefore, it would be difficult to meet the requirement of randomness since it cannot be ensured that every waste container has an equal chance of being selected. Instead, this will be accomplished by partitioning the defined area within each retrieval phase into 192 cubical volumes and randomly selecting volumes for sampling. This equates to three layers approximately 4 ft thick with each layer containing 64 cubical volumes in each defined area. Thirty out of the 192 cubical volumes in each defined area will be randomly selected with the constraint that each layer contains 10 randomly selected cubical volumes. The random selection for each layer is accomplished by listing the 64 cubical volumes in the first two columns of an Excel spreadsheet by a grid numbering scheme. The third column contains random numbers using the rand() function. Then the three columns are sorted based on the column of random numbers. The first ten rows in the sorted column of grid numbers then become the randomly selected cubical volumes for that layer. This is repeated for each layer. The material to be sampled is the homogeneous solids and soil/gravel from the described areas of Pit 4. Debris HWNs are established from AK and do not require sampling and analysis for designation. Material will be retrieved from roughly the center of the cubical volume and sampled at the packaging station. If a debris waste zone is encountered, an alternate sampling location will be identified.

Excavation Location

Identification of the sampling locations begins at the northwest corner of the retrieval area at an elevation of 5,014 ft. The excavation slope will be at 45-degree angles. During recent preretrieval activities, waste was encountered at an elevation of 5,011 ft. Given this, the waste zone will begin at 5,011 ft elevation. Therefore, the area to be included in the random sampling begins 3 ft east and 3 ft south of the northwest corner. Figures 3, 4, and 5 present the randomly selected cubical volumes for each of the three layers in Phase I, respectively. Each layer is smaller than the previous layer due to the 45-degree angle of repose. Tables III, IV, and V present the coordinates of the horizontal center for the randomly selected cubical volumes for each layer of Phase 1, respectively. The samples should be taken at the horizontal center of the cubical volume ±3 ft. Each layer is approximately 4 ft thick and the sample should be collected at the vertical center of the cubical volume ± 2 ft. This would be at elevations 5009 ft, 5005 ft, and 5001 ft. It may turn out that waste is encountered above the anticipated 5,011 ft elevation. Samples should still be collected at the defined elevations.

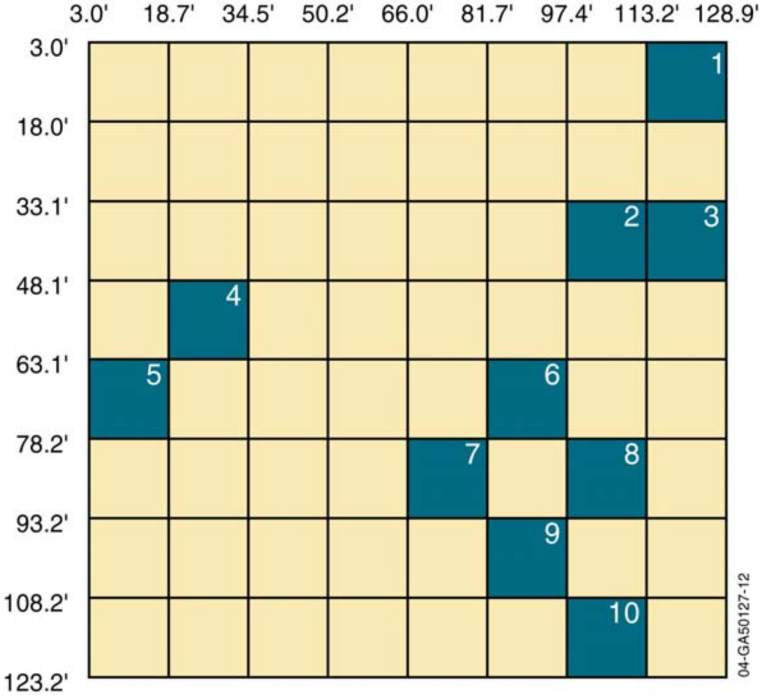

Fig. 3. Random selection of cubical volumes for layer 1 (0–4 ft).

Table III. Layer 1 Grid Center-Points.

Random Sample	Feet in X-Direction from NW Coordinate of Retrieval Area	Feet in Y-Direction from NW Coordinate of Retrieval Area
1	121.1	-10.5
2	105.3	-40.6
3	121.1	-40.6
4	26.6	-55.7
5	10.9	-70.7
6	89.6	-70.7
7	73.9	-85.7

8	105.3	-85.7
9	89.6	-100.7
10	105.3	-115.7

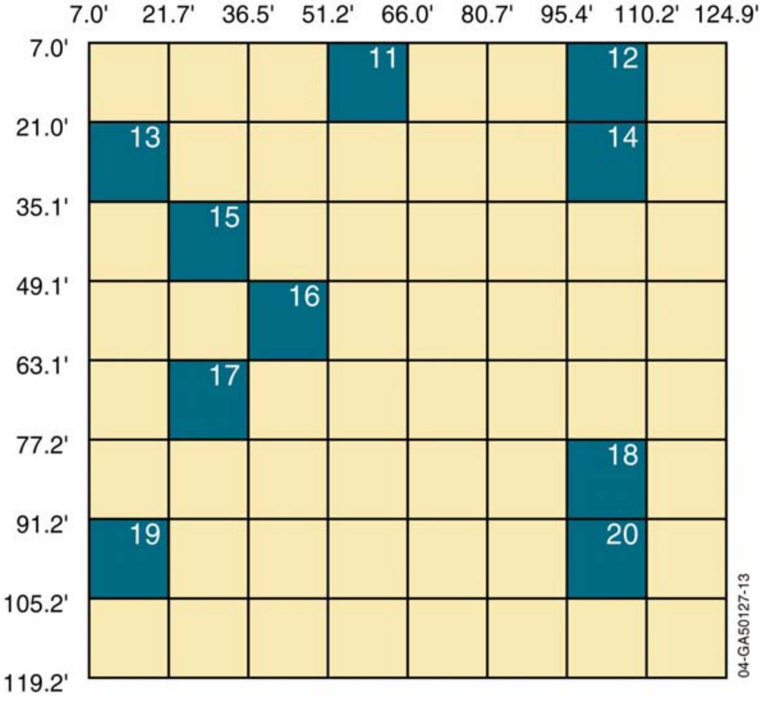

Fig. 4. Random selection of cubical volumes for layer 2 (4–8 ft).

Table IV. Layer 2 Grid Center-Points.

Random Sample	Feet in X-Direction from NW Coordinate of Retrieval Area	Feet in Y-Direction from NW Coordinate of Retrieval Area
11	58.6	-14.0
12	102.8	-14.0
13	14.4	-28.1
14	102.8	-28.1
15	29.1	-42.1
16	43.9	-56.1
17	29.1	-70.2
18	102.8	-84.2
19	14.4	-98.2
20	102.8	-98.2

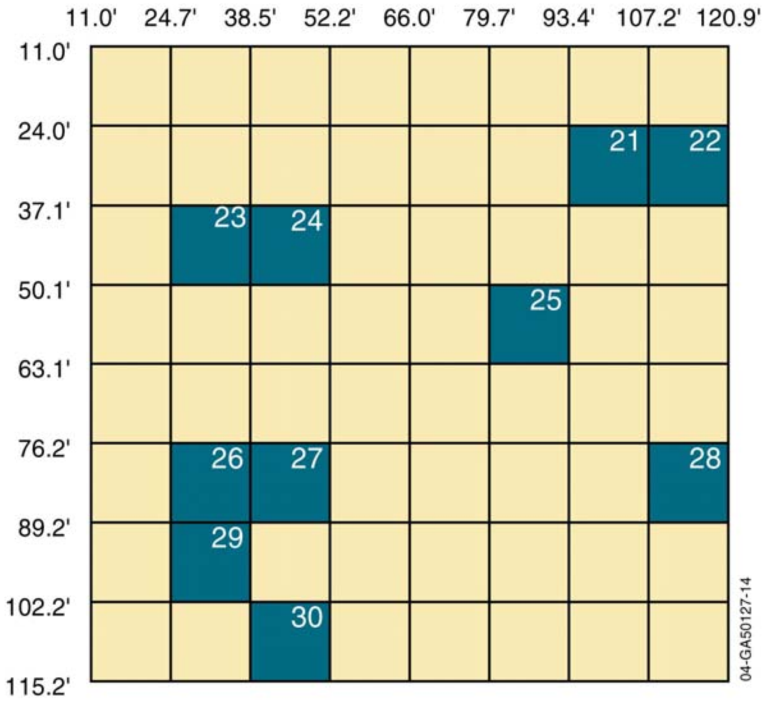

Fig. 5. Random selection of cubical volumes for layer 3 (8–12+ft).

Table V. Layer 3 Grid Center-Points.

Random sample	Feet in x-direction from NW coordinate of Retrieval Area	Feet in y-direction from NW coordinate of Retrieval Area
21	100.3	-30.6
22	114.1	-30.6
23	31.6	-43.6
24	45.4	-43.6
25	86.6	-56.6
26	31.6	-82.7
27	45.4	-82.7
28	114.1	-82.7
29	31.6	-95.7
30	45.4	-108.7

Implementation

Excavation of Cubical Volume

Operations will evaluate the waste zone to determine the material type, for example, homogeneous solids (inorganic or organic waste forms), soil/gravel, or debris (combustibles, metals, glass, etc.). If there is interstitial soil and sludge with the debris, the waste will be excavated. With the exception of an all debris materials area, the waste will be excavated for sampling. If an all debris area, e.g., a waste box with metals or PPE, is located at the sampling coordinates, an alternate sampling location will be identified using the approach outlined below. The excavator shovel will be used to collect approximately 5-8 cubic ft of material with the x, y, z coordinates given in Tables IV through VI. Tolerances on those coordinates are ± 3 ft in the horizontal direction and ± 2 ft in the vertical direction. The material will be placed in a tray and tracked from the excavation site to the repackaging station, at which point chain-of-custody (COC) commences and sample collection activities begin.

A bucket position monitor will be used in conjunction with suspended markers to document the x, y, z location. The bucket position monitor provides the horizontal (reach) and vertical (depth, z) displacement of the center of the bucket, while suspended markers provide the location and depth of each sample. Samples are retrieved by touching a suspended marker with the side of the excavator bucket and documenting the horizontal distance from the excavator cab (displayed within the excavator cab on a depth monitor) and the vertical distance from the bottom of the excavator tracks (also displayed within the excavator cab on a depth monitor). The sample volume will be excavated from the appropriate depth, indicated on the marker, while maintaining the same horizontal distance from the excavator cab. Using the bucket position monitor in concert with the suspended markers, the project's sampling data will be correlated with the location of waste in the pit. Operators will keep track of each scoop of waste identified for sampling by recording the scoop location, which will be correlated to the drum number in which the waste will be packaged.

Alternate Sampling Location

If a selected sample location turns out to be all debris, the preselected coordinates cannot be used for sampling and a replacement location is necessary. The replacement strategy entails sampling the first acceptable waste form that is identified in the direction that excavation is proceeding. The replacement sample and associated x, y, z coordinates that are excavated will be documented. If the dig is progressing in the east-west direction, the new horizontal distance from the excavator cab to the sample location will be used to determine the sample coordinates. If the dig is progressing in the north-south direction, the alternate sample location will be identified using bucket widths from the original coordinates.

Tray Tracking

The excavated material identified for sampling will be loaded onto a tray for transport to the packaging area. The tray to be sampled will be noted in the sample logbook and tracked to the packaging/sampling location. At a minimum, the material collection location and the date will be logged. The tray will be visually flagged for sampling when it reaches the packaging area. As soon as possible, the tray will be transferred to the repackage station for sampling.

Sample Collection from Tray

The sampling approach within the tray will be to obtain samples representative of the tray contents. The tray will be divided into quadrants: 1-top left; 2-top right; 3-bottom left; and 4-bottom right. The sample will be collected from a randomly selected quadrant.

The sampling process requires the collection of approximately 350 mL of materials from the flagged tray. Samples will be collected from the components present in the randomly selected quadrant. This could include sludge, cemented sludge, and soil. If a solid mass of material, e.g., solidified waste, is encountered, a hammer and chisel will be used to collect the needed volume. The material from the samples will be composited. If needed, the hammer and chisel will be used to reduce solid materials to a size appropriate for homogenization and sampling. The operator will use best professional judgment in making this determination.

The sample will be placed into appropriate sample containers for RCRA analysis. The samples will be loaded out of the packaging station using a double-door transfer container, placed on ice, and transported to a sample refrigerator for storage at 4°C.

Collocated Sample Collection

The collocated sample methodology, described in the WAP, is a duplicate sample collection methodology intended to collect samples from approximately the same location. WAP B1-2b(1) states that a collocated sample shall be collected side by side as close as feasible to the primary sample, handled in the same manner, and sampled in the same manner at the same randomly selected sample location(s). Collocated samples shall be collected at a frequency of one per sampling batch or once per week, whichever is more frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples) all of which shall be collected within 14 days of the first sample in the batch. The sample collection methodology will be the same as described above for sample collection from tray.

Approximately 350 mL of sample material will be collected, mixed, and then sampled using a scoop into the appropriate containers for shipment to the ALD. The samples and containers must be cooled to 4°C for storage and transport.

Certification Authority

The INEEL ALD will complete analysis of the samples for all WIPP-required target analytes per WIPP-approved procedures. The CCP will implement the sampling and validation of the data under their certification authority.

CONCLUSIONS

The AR Project’s solids sampling and analysis approach is unique in the DOE complex. Current practice is to identify the drums within a waste stream, randomly select the drums to be sampled, core the identified drums, complete sample analysis of each core, and apply the hazardous waste codes across the entire waste stream. This approach has several disadvantages to the AR Project. The retrieved waste will be commingled with soil, so the number of drums cannot be estimated prior to retrieval of the entire retrieval area within Pit 4. To ensure that every drum within the waste stream population has an opportunity to be randomly selected, sampling and analysis could not be initiated until the entire Pit was retrieved. From an operations perspective, this is undesirable. An approach, therefore, was selected which allows for solids sampling and analysis to be accomplished during excavation operations, independent of the number of TRU waste drums generated. This sampling and analysis approach has significant advantages for the AR Project when compared to post-packaging coring. The approach is real-time, requires no post-packaging coring/sampling, and is consistent with EPA’s SW-846, Chapter 9 sampling methodology and the characterization requirements identified in CBFO’s WAP.

The hazardous waste codes determined by AK for each as disposed waste forms will be summed and uniformly applied to the waste retrieved from the described area in Pit 4. It is this suite of hazardous waste codes that will be confirmed by sampling and analysis.

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ACKNOWLEDGEMENTS

Work supported by the U.S. Department of Energy, Assistant Secretary for Environmental Management, under DOE Idaho Operations Office Contract DE-AC07-99ID13727.